

# Non Revenue Water in South Africa and tools to support improvements

**JN BHAGWAN**

# History of WRC activity

- Late 80's attention towards water consumption
  - GJ Malan : water consumption and savings in apartment buildings
  - Castle Brass holdings : Water Loss analysis in municipal distribution systems
  - CSIR : Testing of data logging equipment
  - SABS : Influence of fittings on domestic meters
- Pipelines research in the late (corrosion and biofilms)
  - Evaluation of metal pipe leaks in JHB area
  - Corrosion performance of non-metallic pipes
  - Exposure of generic coatings
  - Effect of water quality and chemical composition on corrosion

# Three responses

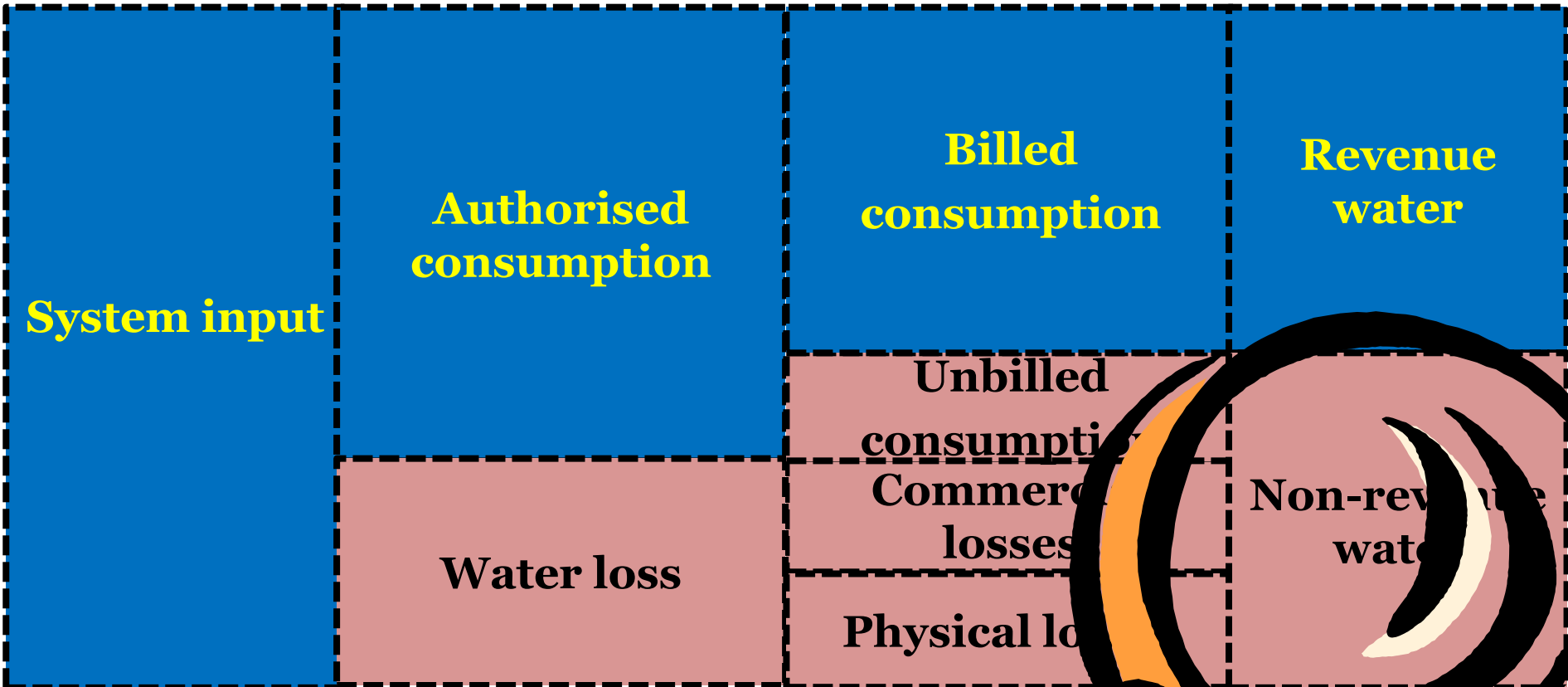
- Development of aids and tools
- Asset management
- National surveys



# Background Information

- Benchmarking of Leakage from Water Reticulation Systems in South Africa (WRC, TT 244/05); **March 2005**, 27 systems
- An assessment of Non-revenue water in South Africa (WRC, TT 300/07); **January 2007**, 62 systems
- National Non-Revenue Water Assessment (DWA, Business Intelligence); **April 2010**, all municipalities
- Latest NRW study, **June 2011**

# Latest National Non-Revenue Water Assessment based on the standard IWA Water Balance

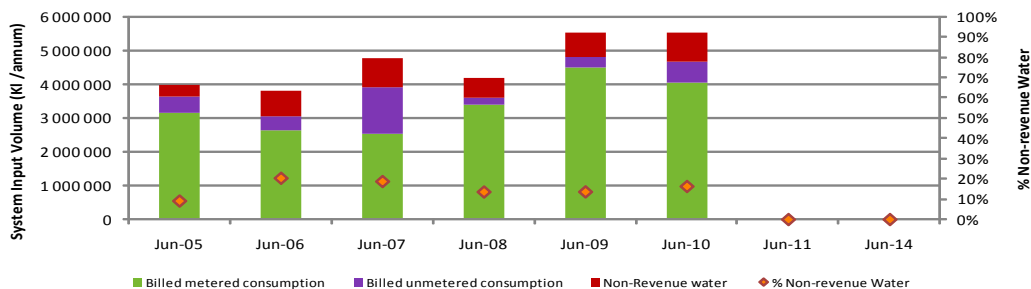


Province		Limpopo							WSA	
Municipal Code		LIM362							Yes	
District Municipality		Waterberg							Category	
Municipality		Lephalale							B3	
Settlements		ELLISRAS							Target	
Year ending		Jun-05	Jun-06	Jun-07	Jun-08	Jun-09	Jun-10	Jun-11	Jun-14	
Input Data	Population	101 453	102 736	103 349	104 120	104 745	114 595			
	Households	25 928	26 256	26 410	26 610	26 767	27 950			
	Connections - metered						8 020			
	Connections - Unmetered						19 930			
	Length of mains (km)						512 297			
	System input volume	kl/annum	3 978 000	3 808 840	4 780 000	4 170 000	5 540 000	5 540 000		
	Billed metered consumption	kl/annum	3 134 400	2 636 000	2 535 000	3 377 700	4 487 400	4 044 200		
	Billed unmetered consumption	kl/annum	486 900	411 072	1 365 000	235 974	310 698	608 000		
	Unbilled metered consumption	kl/annum								
	Unbilled unmetered consumption	kl/annum								
Water Balance Calculations	Revenue water	kl/annum	3 621 300	3 047 072	3 900 000	3 613 674	4 798 098	4 652 200	0	0
	Non-Revenue water	kl/annum	356 700	761 768	880 000	556 326	741 902	887 800	0	0
	Water Losses	kl/annum	356 700	761 768	880 000	556 326	741 902	887 800	0	0
	% Non-revenue water		9.0%	20.0%	18.4%	13.3%	13.4%	16.0%	No data	No data
	% Water Losses		9.0%	20.0%	18.4%	13.3%	13.4%	16.0%	No data	No data
Key performance indicators	Input : Litres / capita / day		107	102	127	110	145	132	No data	No data
	Input : m³ / household / month		13	12	15	13	17	17	No data	No data
	Billed : Litres / capita / day		98	81	103	95	125	111	No data	No data
	Billed : m³ / household / month		12	10	12	11	15	14	No data	No data
	% Population growth			1.26%	0.60%	0.75%	0.60%	9.40%		
	% Water demand growth			-4.25%	25.50%	-12.76%	32.85%	0.00%		
Source of information		DWA NIS StatsSA NFC	DWA NIS StatsSA NFC	DWA NIS StatsSA NFC	DWA NIS StatsSA NFC	DWA NIS StatsSA NFC				

# NRW Reporting Template

- 6 years of data
- Various sources
- Updated and verified by team and municipalities
- Most comprehensive database

Municipal NRW Water Balance: Lephalale

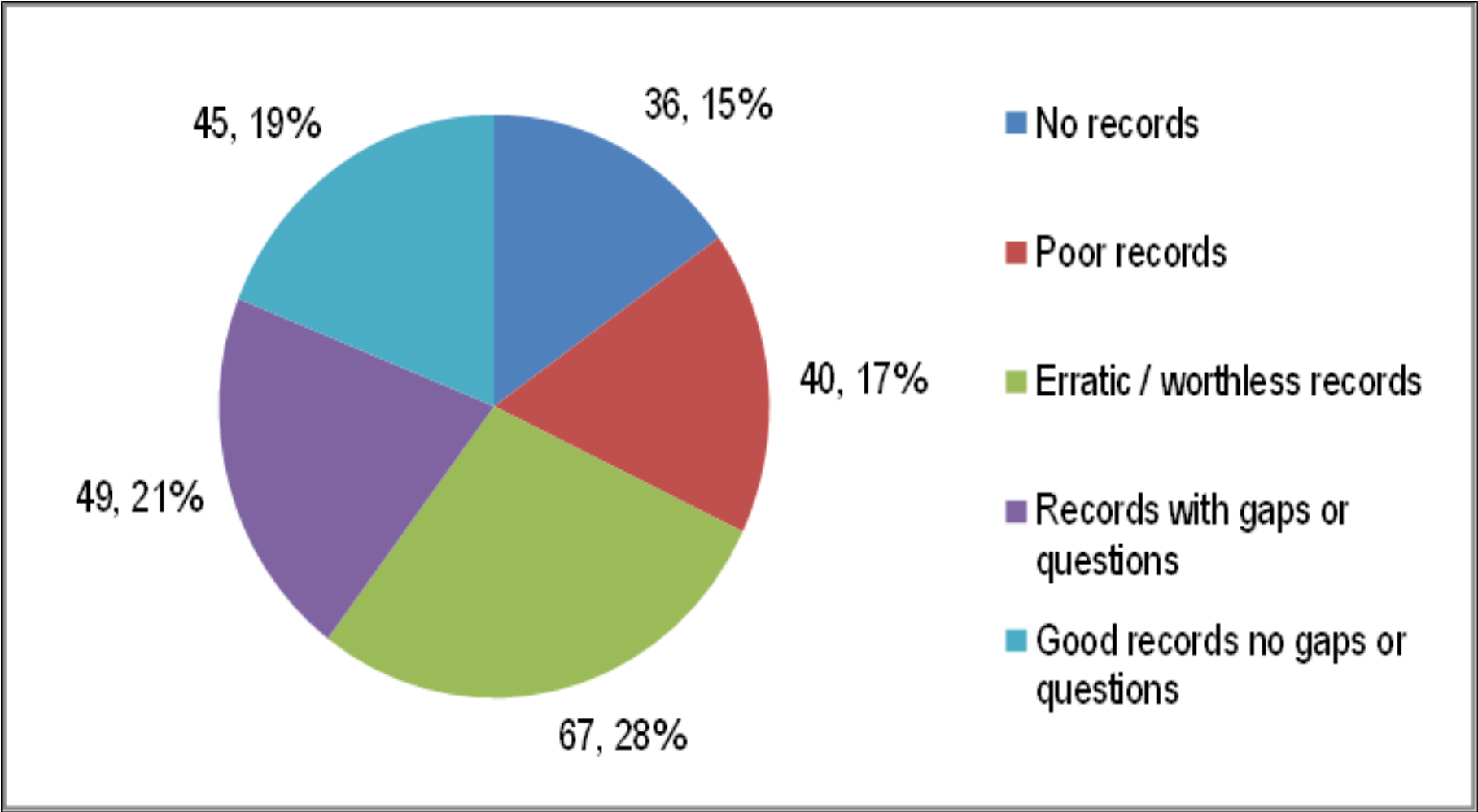


Comments

# Common errors / problems

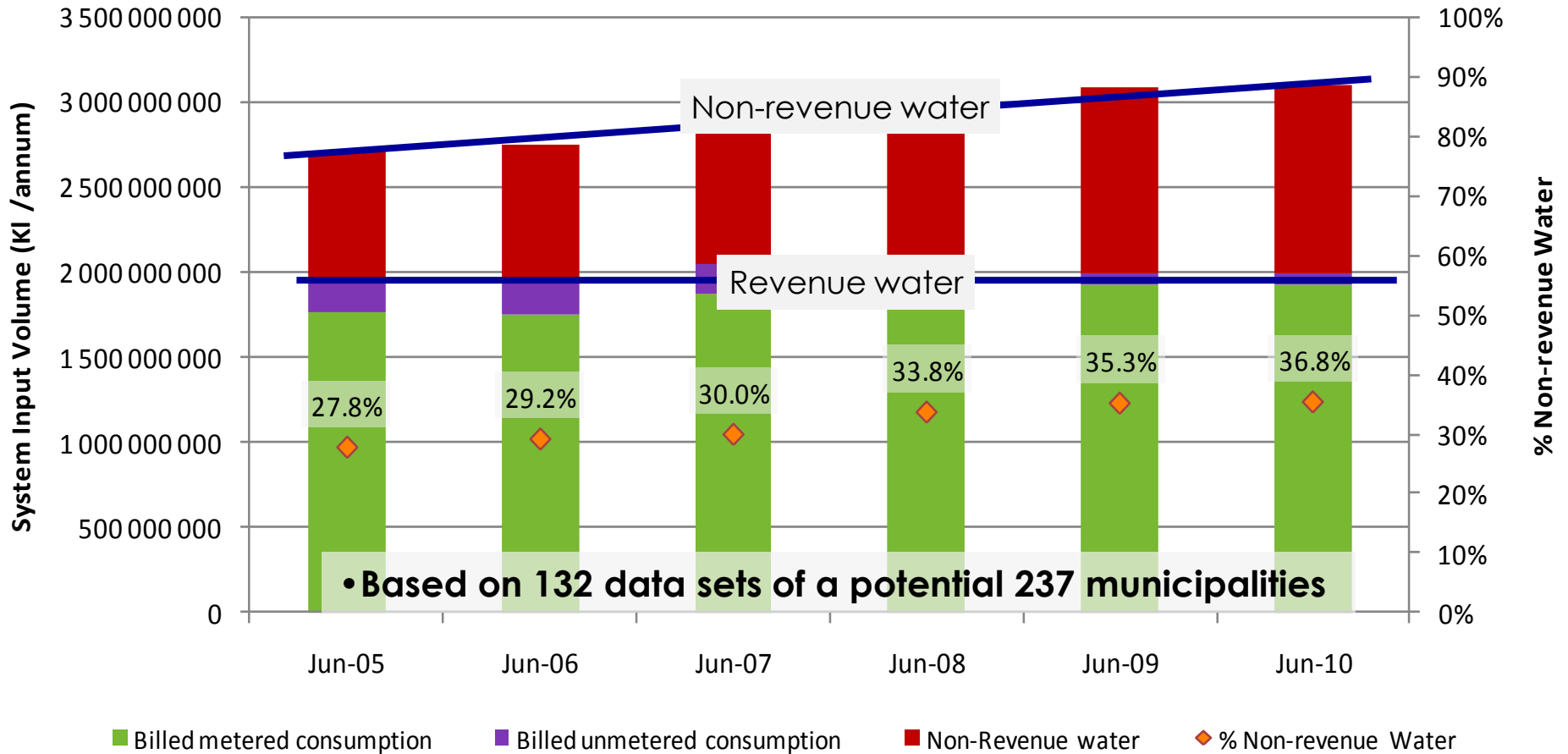
- **Factor 1000 errors – Mℓ, kℓ, million m<sup>3</sup>**
  - Corrected errors through annual comparisons, unit consumption or other data sources
- **Definition confusion**
  - Water “exported” – excluded from input volume but included in billed consumption
  - Free Basic Water (FBW) – possible duplication in billed consumption
  - Flat rate consumption – uncertainty on where it fits in the water balance

# 6 Year Record Keeping Summary





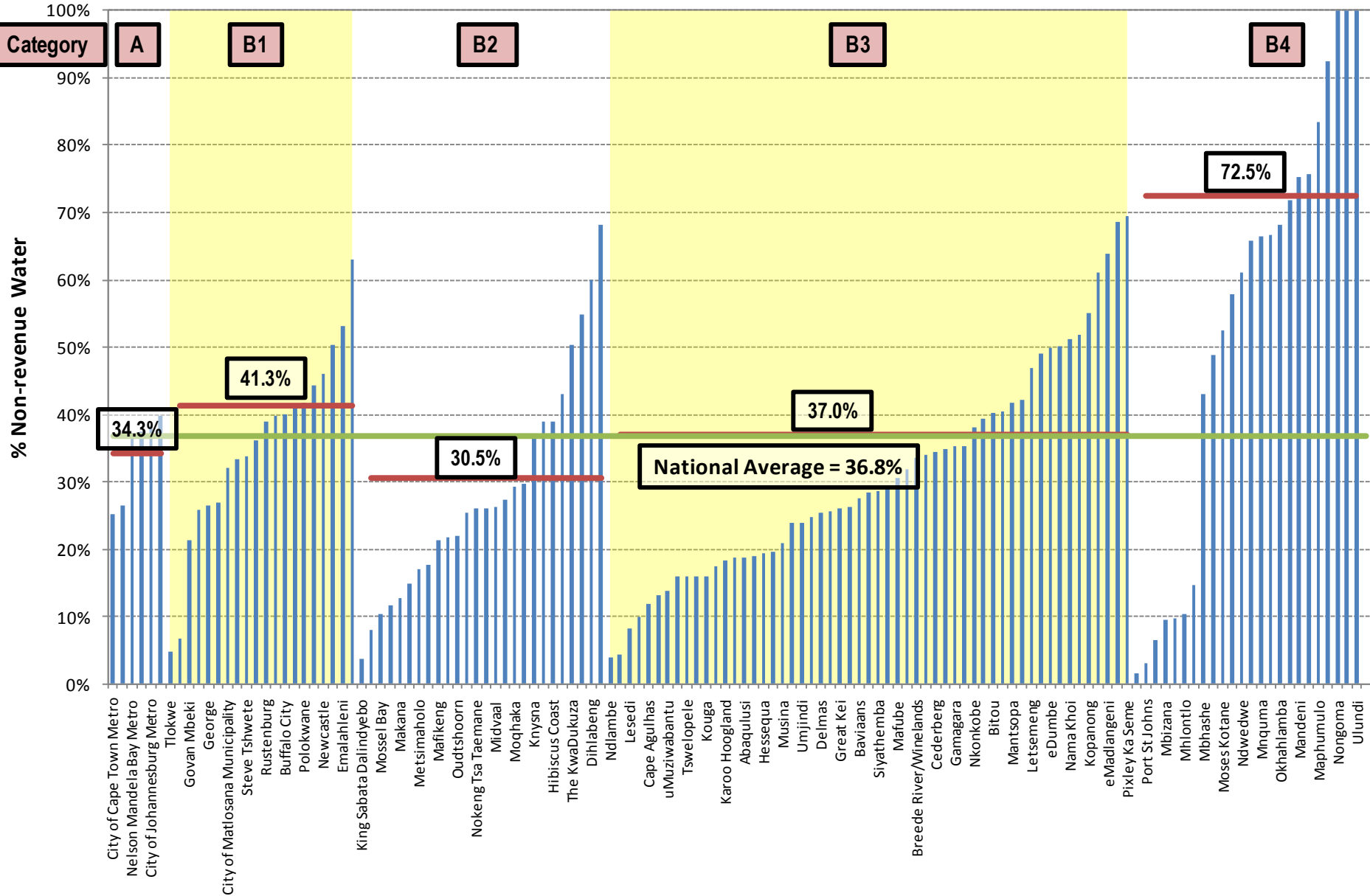
# Preliminary National Non-revenue Water Assessment



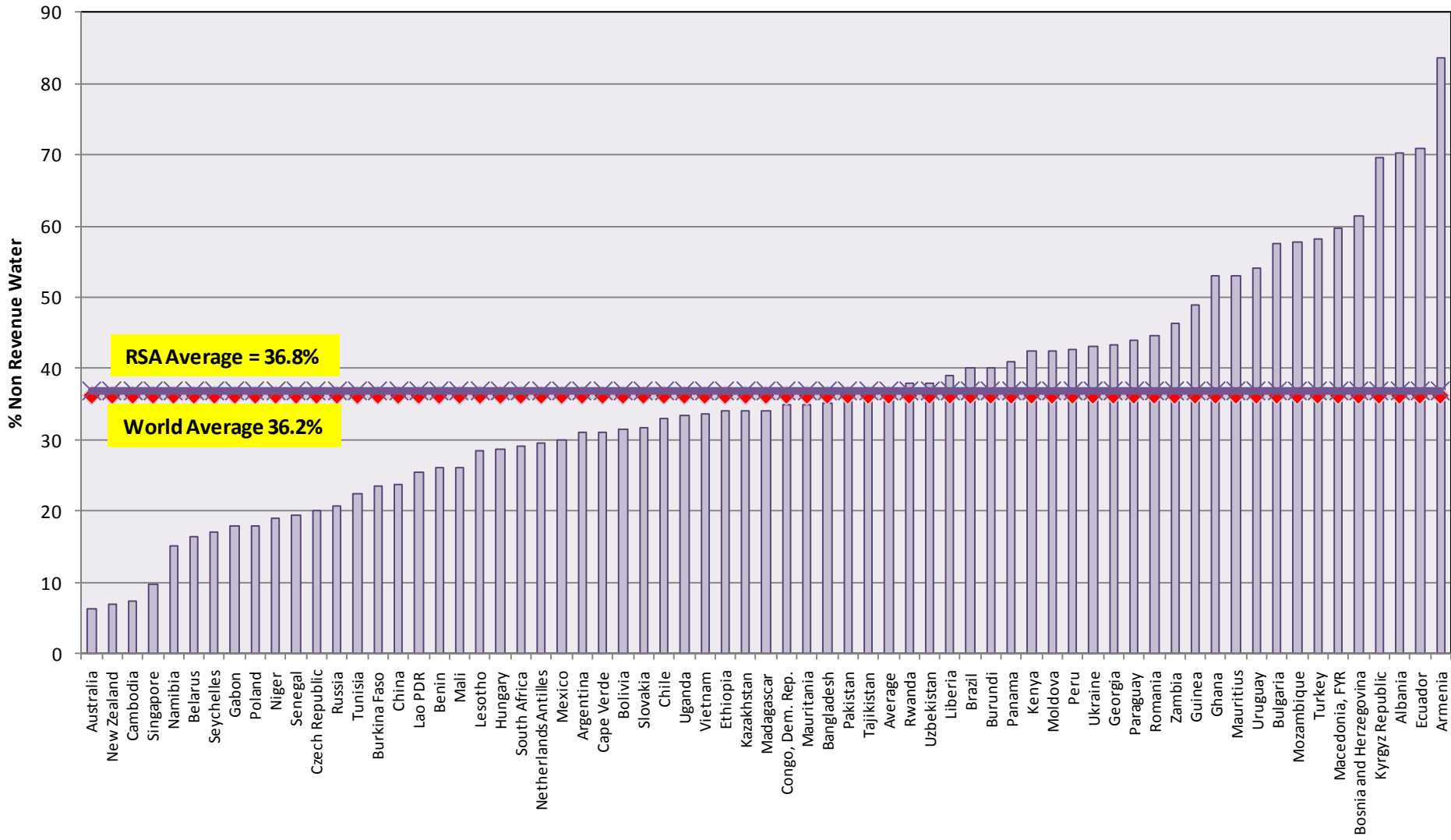
# Current Municipal Environment

- Limited skilled resources with high staff turnover
- Limited asset management
- Poor or no consumer metering and billing
- No incentive to conserve water
- Lack of WC/WDM knowledge and insight
- Insufficient management information

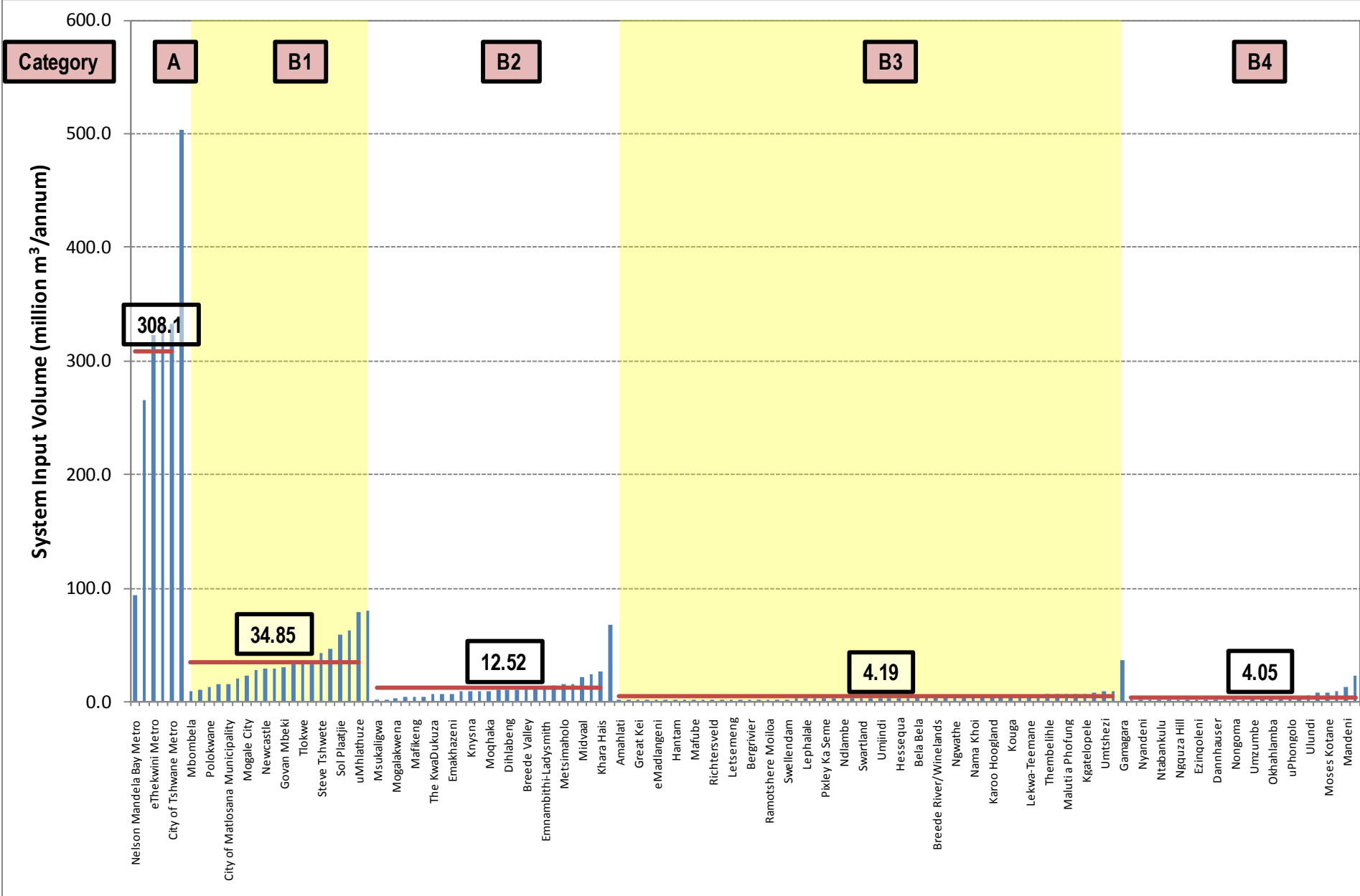
# % NRW Distribution / Municipal Category



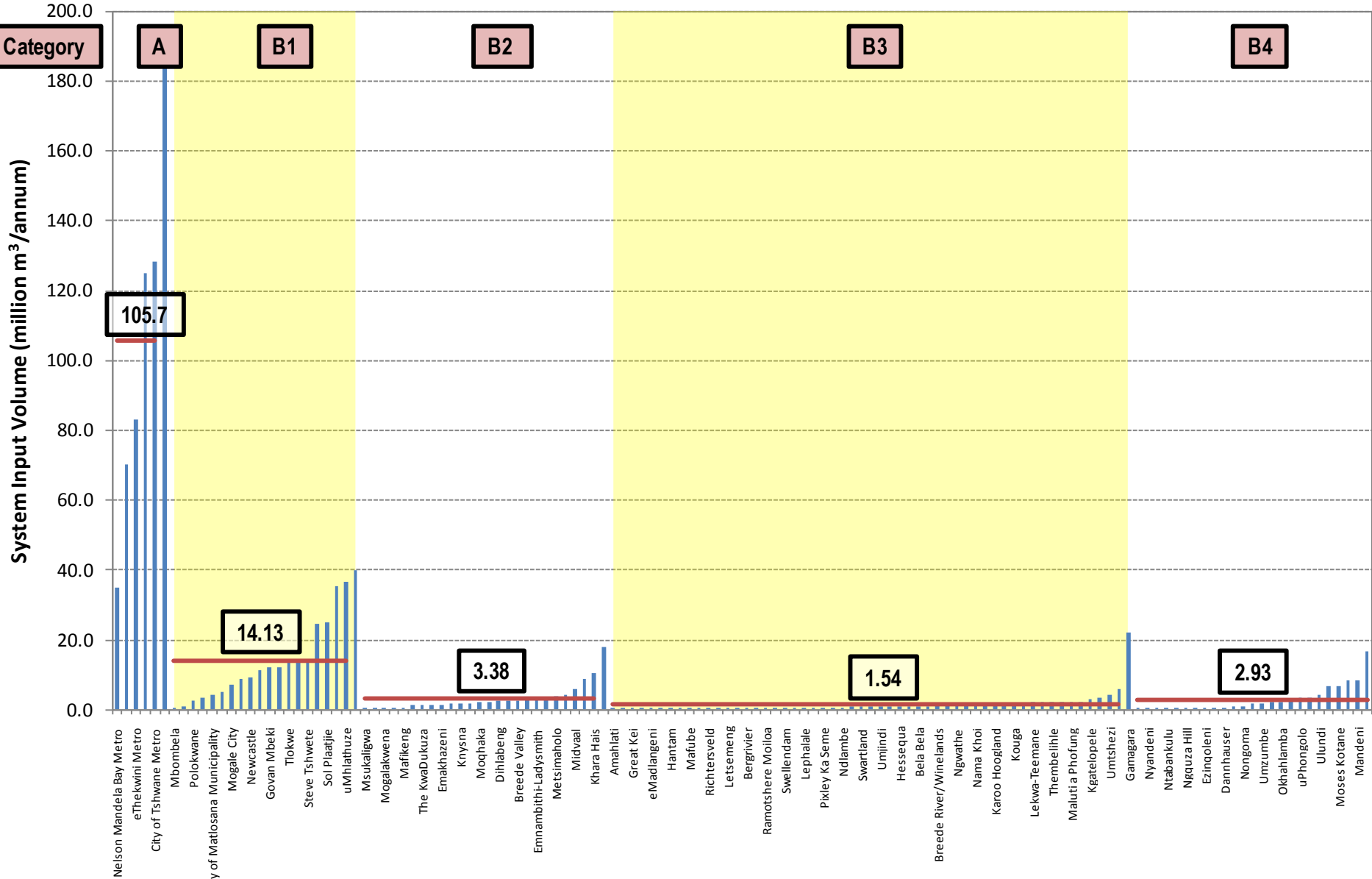
# International NRW benchmark



# System Input Volume / Category



# Volume NRW / Category



# Estimated National NRW

NRW Based on Available Data Sets					
Category	Population	Input (m <sup>3</sup> /a)	NRW (m <sup>3</sup> /a)	% NRW	l/c/d
A	17 420 512	1 849 091 117	634 192 022	34.3%	291
B1	7 756 187	683 667 320	282 585 164	41.3%	241
B2	3 882 070	325 623 095	99 407 207	30.5%	230
<b>Urban</b>	<b>29 058 770</b>	<b>2 858 381 532</b>	<b>1 016 184 393</b>	<b>35.6%</b>	<b>269</b>
B3	3 845 279	230 642 568	85 229 869	37.0%	164
B4	4 245 736	101 138 956	73 334 514	72.5%	65
<b>Rural</b>	<b>8 091 015</b>	<b>331 781 524</b>	<b>158 564 384</b>	<b>47.8%</b>	<b>112</b>
<b>National</b>	<b>37 149 785</b>	<b>3 190 163 057</b>	<b>1 174 748 776</b>	<b>36.8%</b>	<b>235</b>
<b>Extrapolated</b>	<b>48 821 707</b>	<b>4 192 465 880</b>	<b>1 543 837 752</b>	<b>36.8%</b>	<b>235</b>

# Estimated Cost of NRW

Category	Production Rate (R/kl)	Estimated supply cost (R million)	Estimated value of NRW (R million)
A	R 5.00	R 9 245.46	R 3 170.96
B1	R 4.50	R 3 076.50	R 1 271.63
B2	R 4.00	R 1 302.49	R 397.63
<b>Urban</b>		<b>R 13 624.45</b>	<b>R 4 840.22</b>
B3	R 3.50	R 807.25	R 298.30
B4	R 3.00	R 303.42	R 220.00
<b>Rural</b>		<b>R 1 110.67</b>	<b>R 518.31</b>
National		R 14 735.12	R 5 358.53
<b>Extrapolated</b>		<b>R 19 827.42</b>	<b>R 7 210.38</b>



## Conclusions (2)

- % NRW and l/c/d in line with international trends
- 103 (44%) of municipalities cannot supply a water balance
- 36 (15%) of municipalities have never submitted water balance data in a six year period
- 45 (19%) of municipalities have good water balance data with no gaps or questions



• 4 WRC  
• MODELS





# Sanflow

*Press any key to continue.....*

*Version 2.0.3: March 2009*



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Designed by:  
**Ronnie McKenzie**



# CONOLEAK



**WTP**

WATER RESOURCE  
PLANNING AND  
CONSERVATION



**SOUTH AFRICAN  
WATER RESEARCH COMMISSION**



# Presmac

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*Version 2.0.3 March 2009*



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**Ronnie McKenzie**

# WATER AUDIT SOFTWARE: SOUTH AFRICA

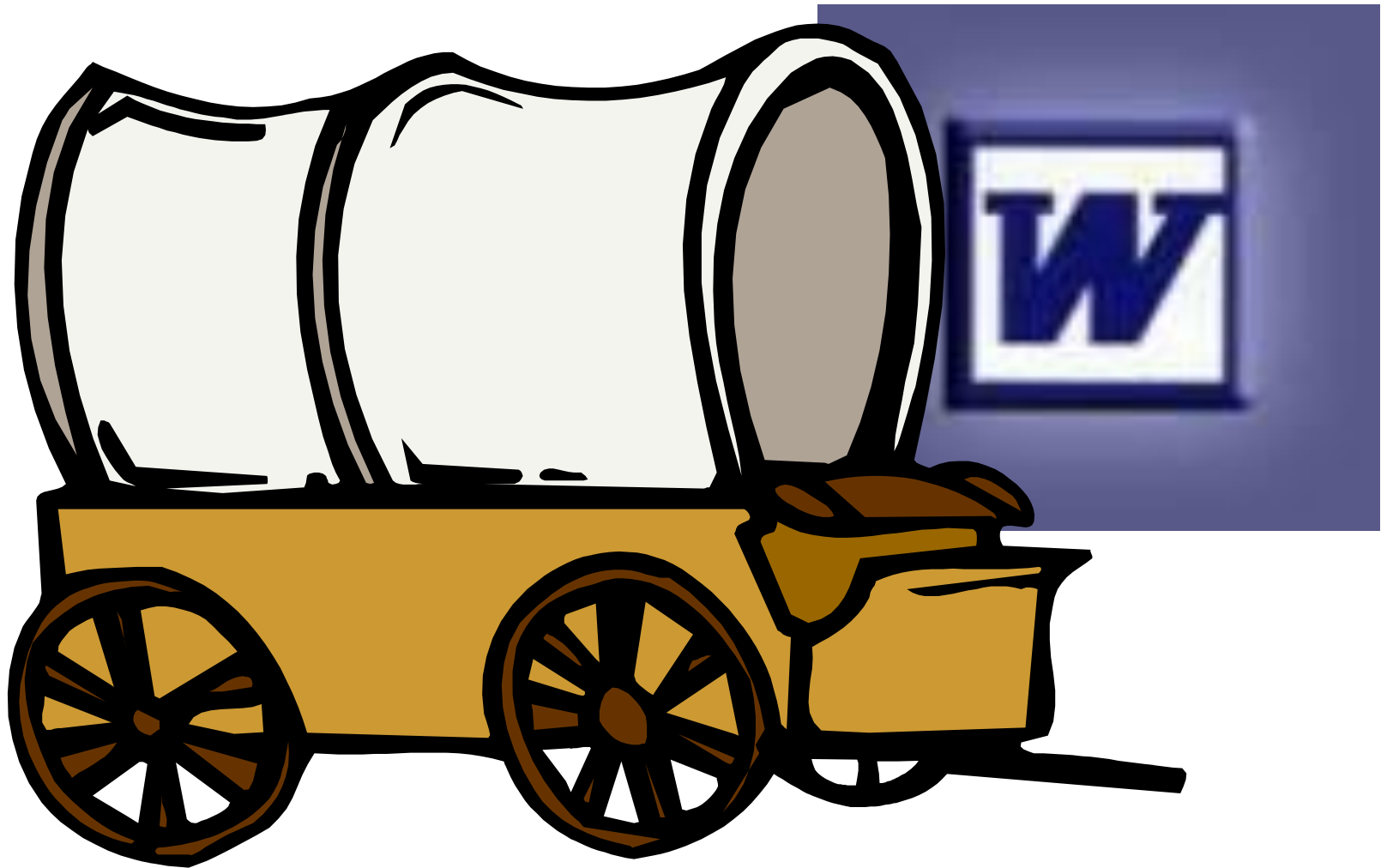


The background of the slide features a large, stylized green letter 'R' on the left. To its right, the word 'BENCHLEAK' is written in large, bold, green and yellow 3D-style letters. Behind the text are several overlapping documents, including a 'CHECK SHEET FOR LEAKAGE INVESTIGATION IN SOUTH AFRICA' and various charts and graphs. The overall background is a light green with faint, circular patterns.

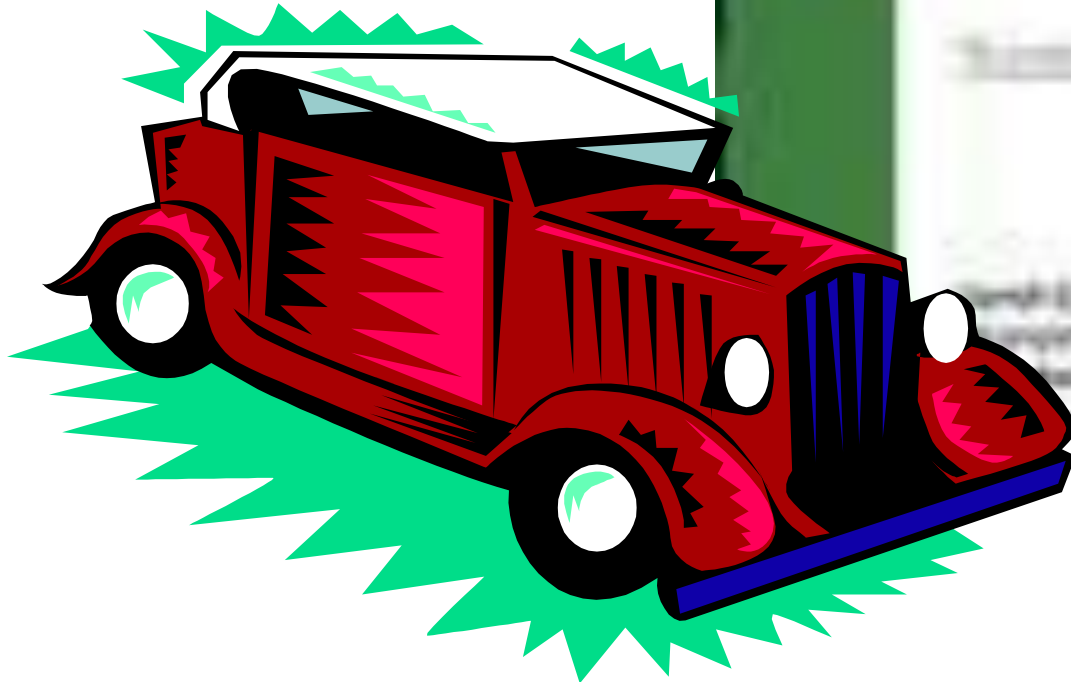


SOUTH AFRICAN  
WATER RESEARCH COMMISSION





# • WATER AUDIT SOFTWARE







# AquaLite

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*Version 2.0.4 January 2009*



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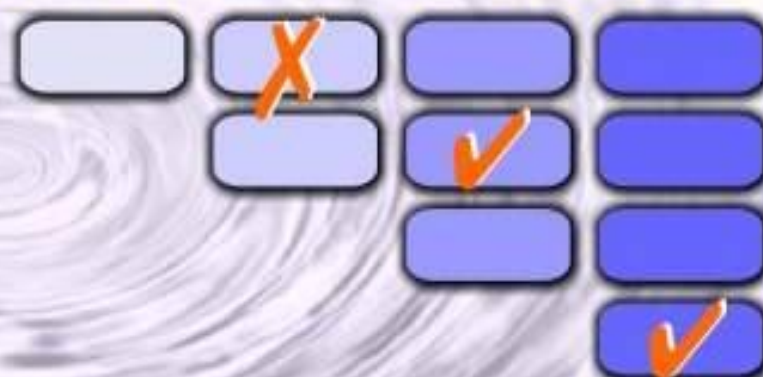
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*Version 2.1 May 2010*

# Municipal WDM Score Card



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# • Infrastructure Asset Management

- Planning, budgeting and evaluation
- Design
- Procure & construct
- Operate
- Maintain
- Refurbish/rehabilitate







• Water Treatment



• Distribution



• Resource



• Consumer



• Catchment



• Wastewater Treatment

• Municipalities must operate, maintain monitor & manage assets from resource to consumer to resource

# Infrastructure Asset Management Toolkit

Version 1



TT 413/09  
April 2009

# Tools Developed

- **Vulnerability** – probably or likelihood of event occurring.
- **Risk** – probably/likelihood & consequence /impact of event.
- Two tools
  1. **waterVUL** – Water Infrastructure Vulnerability Assessment Tool
  2. **waterRISK** – Water Infrastructure Risk Assessment Tool





Guidelines on  
**Water Services**  
Infrastructure Risks Management

Unathi Jock, Philip de Souza and Grant Mackintosh

TR 507/11  
December 2011





The background of the cover is a colorful, abstract illustration of water pipes and a water meter. A blue pipe with a red valve is at the top. Below it, a large circular water meter is shown with a red needle and a digital display showing '00000010'. The meter's face is filled with blue wavy lines. The overall design uses a palette of blue, red, orange, and green.

**INTRODUCTION TO  
INTEGRATED  
WATER METER MANAGEMENT**

EDITION 1

**JE van Zyl**



TT 490/11







- ***KEEP IT SIMPLE***

- **THANK YOU**